EXHIBIT A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appln. No:	10/786,188
Applicant:	Benjamin Sonnenreich et al.
Filed:	February 25, 2004
Title:	BONDING TOOL WITH POLYMER COATING
TC/A.U.:	1725
Examiner:	Len Tran
Confirmation No.:	2392
Docket No.:	K&S-101US1

DECLARATION UNDER 37 C.F.R. §1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

We, Benjamin Sonnenreich and Siglalit Robinzon, hereby declare that:

1. We are the co-inventors of the subject matter of the patent application identified above and are familiar with the contents of that patent application.

2. The purpose of this declaration is to establish completion of the invention of the subject matter disclosed in the application in the United States, a NAFTA country, or a WTO member country at a date before March 27, 2000.

3. All of the acts described in this declaration took place within the United States or Israel (a WTO member country as of April 21, 1995).

4. At the time of our contribution to the conception and reduction to practice of the invention, each of us inventors was an employee of Kulicke and Soffa Investments (K&S), the assignee of the present invention, or a commonly owned subsidiary and under an obligation to assign the invention to the assignee.

5. We conceived of the invention disclosed and claimed in the subject application at least as early as April 18, 1999, a date earlier than the earliest effective filing date of U.S. Patent Publication 2004/0129755 (the '755 publication).

6. We next submitted an Invention Disclosure form disclosing our invention to our employer, K&S, on or about September 27, 1999, a date still earlier that the earliest effective filing date of the '755 publication. A copy of our initial invention disclosure is attached hereto as Exhibit 1.

7. On or about September 27, 1999, the K&S Legal Department received our Invention Disclosure form and began evaluation of the merits of our invention to determine whether to file a patent application.

8. By February 24, 2000, a date still earlier than the earliest effective filing date of the '755 publication, the K&S Legal Department had completed its evaluation and requested that the law firm of Ratner & Prestia prepare a patent application covering our invention of a bonding tool with polymer coating. A copy of the authorization letter to Ratner & Prestia is attached hereto as Exhibit 2.

9. A draft application was completed by Ratner & Prestia, reviewed and revised by us as the inventors. The final draft application was submitted to us on or about January 25, 2001 for final review and approval. Ratner & Prestia then proceeded to file the parent of the subject patent application, Serial No. 09/772,421, in the United States Patent and Trademark office on January 30, 2001.

10. The aforementioned parent application (Serial No. 09/772,421) was subject to a Restriction Requirement, in which we as the inventors elected to prosecute the apparatus claims.

11. The subject divisional patent application was filed in the United States Patent and Trademark office on February 25, 2004 claiming the previously non-elected method claims.

12. From the time of conception and reduction to practice, we diligently worked with our patent attorneys to prepare and file the subject patent application. At no time was the invention abandoned, suppressed, or concealed.

13. The invention covered in the subject patent application was neither disclosed to anyone outside of K&S without a confidentiality agreement nor on sale or in public use more than one year before the filing of the parent application on January 30, 2001.

14. Exhibits 1 and 2 represent documents internal to K&S and were created and distributed in a confidential manner.

15. From the above statements and the documents contained in Exhibits 1-2, it can be seen that the invention in this application was made before the earliest effective date of the '755 publication.

16. The following exhibits are attached to this Declaration:

EXHIBIT	DESCRIPTION
1	Invention Disclosure Form
2	Authorization letter to patent counsel

17. By each of our signatures below, we hereby declare that all statements made in this document of our own knowledge are true, and that all statements made on information and belief are believed to be true. Further, we hereby declare that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing on the application

Respectfully submitted,

Dated: 10.5.2005

Benjamin Sonnenreich

Dated: 8.5.05

Siglalit Robinzon

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EXHIBIT 1

KS-10105

GMB

Company Confidential

Kulicke & Soffa Industries, Inc.

INITIAL INVENTION DISCLOSURE

Location: Micro-Swiss	*Organization:*	*File/Docket #* KSI-227

Title of Invention:
A Bonding tool with Inner and / or Outer Plastic Coating, for Low drag force and longer life span

Inventor(s) - Full Name:
Sonnenreich Benjamin
Robinzon Sigalit

Prepared By:	*Date:*	*Supervisor:*	*Patent Rep.:*
Robinzon Sigalit	16.9.99	Ilan Hadar	

1. Brief Description:
Coating the bonding tools with a thin layer on the inner / or inner and outer side of the bonding tool.

1. Purpose:
Reduce drag force and contamination build up at the bonding tool Tip and at the inner parts of the bonding tool, in order to increase the life span of the bonding tool and improve the wire bonding looping quality.

2. What is new or different?
Coating the bonding tools with a thin plastic layer on the inner and outer side of the bonding tool. This special plastic coating withstands the high temperatures and the impacts of the bonding process.

3. Advantages over past practice:
Contamination build-up and looping problem due to high drag force reduces the life span of the bonding tools and degrades the looping performances. New bonding tool design, which includes inner plastic coating, reduces this phenomenon and therefore, improves the process quality.

4. Identify first written record:
April 1999

5. Date and names of those to whom first disclosed and/or first test:
April 18th 1999 , Benjamin Sonnenreich

6. Other writings: publications, patents, products which relate to this invention:
Bonding tool Tip coating patent was filled recently by same inventor (KSI-136), (KSI-174)

7. Source	*System/ Program:*	*Project No.*	*Other:*

8. Attach description and sketch to convey concept. Important: attach copies of all descriptive material and sketches (including notebook entries, technical memos, schematics, etc.) necessary to explain paragraph 1.

Signature of witness:	*Date:*	*Signature of inventor:*	*Date:*
	27-9-99		27.9.1999
Signature of witness:	*Date:*	*Signature of co-inventor:*	*Date:*
	27-9-99		27.9.99
Signature of witness:	*Date:*	*Signature of co-inventor:*	*Date:*

Kulicke & Soffa Industries, Inc.

Company Confidential

GMB

INITIAL INVENTION DISCLOSURE

Name:	date	for KSI-

Where is it used (or to be used)?

It was used only at Micro-Swiss' Lab.

When was it, or will it, be exhibited or shown:
- to the public?
- to anyone outside K&S?

It is planed to be presented at Semicon Singapore, May 2000.

Is it included in a non-disclosure Agreement? (if one exists)

The company that coated the capillaries for us, signed an NDA.

To your knowledge, what is the prior art? Patent
- Patents ✔
- Publications
- Machine/Equipment
- Other

Inventor's additional information & comments

KSI - 227

A Bonding Tool with Inner and/or Outer Polymer Coating, for Low Drag Force and Longer Life Span

Benjamin Sonnenreich and Sigalit Robinzon
MicroSwiss, Kulicke and Soffa Industries

Field of Use:	Wire Bonding
Description:	Polymeric Coating of Bonding Tools
Purpose:	Reduced Drag, Longer Life Span and Enhanced Process Stability of Wire Bonding Tools and Processes.
Advantages:	Lower Wire Drag, Reduced Contamination Build-Up, Enhanced Life, Reduced Process Variation Over Time.
Reviewer:	Dr. Timothy Ellis, Director, Materials Research Laboratory, Kulicke and Soffa Industries

Introduction:

Wire bonding is, at this time, the dominant method for the interconnection of semiconductor-based devices. In the wire bonding industry, tool failure leads to the destruction of the semiconductor device being interconnected, which can significantly lower yields. To prevent tool failures, tools are exchanged regularly prior to the predicted time to failure. In the wire bonding industry, a wire bonding process is defined by the "Process Window", which is the range of parameters that the bonding machine is qualified to operate. To maintain bond quality, adjustment must be made to the bonding parameters, however, bonding parameters are not allowed to be outside of the approved process window. This leads to a loss of productivity as the bonding process must be stopped and tools exchanged. Additional expense is incurred as a larger number of tools than necessary are used.

Contamination, build-up and accelerated wear limit the use time for ceramic-based tools (e.g. Alumina, Zirconia Toughened Alumina, cemented Tungsten Carbide) in wire bonding applications. Adhesion of organic-derived carbonaceous material and the subsequent embedding in the carbonaceous material of metallic particles from the wire causes unsymmetrical loading of the tool and leads to mechanical failure by flexural bending. Enhanced surface wear is also noted due to the localization of bonding forces to a point load on the tool face. The carbonaceous material is produced by the action of the Electric Flame Off (EFO, for ball formation) on the petroleum- and stearate-based materials placed on the wire surface to improve de-spooling of the wire. To address this situation, a coating process has been developed, whereby a polymer coating (e.g. Paralyene) is deposited on the surface of a newly produced bonding tool. This surface coating is found to reduce the adhesion of carbonaceous contaminants to the surface of the bonding tool, thereby increasing the time to failure and stabilizing the process window.

The efficacy of a polymer coating in improving the reliability and stability of the wire bonding process is shown in Figures 1-5. Figure 1 shows the stabilization of the required bonding force, which is lower for the polymer coated capillary than a convention un-coated capillary. Figure 2 exhibits a lower variation in bond power versus accumulated number of bonded wires for a coated capillary. Figure 3 shows a lower variation in the average ball size for a coated capillary. Figure 4 delineates the change in the Ball Size Ratio versus number of bonded wires, again, showing a lower variation with the polymer coated capillary, Finally, in Figure 5, the 1st Bond performance is found to be higher and more stable with a coated capillary.

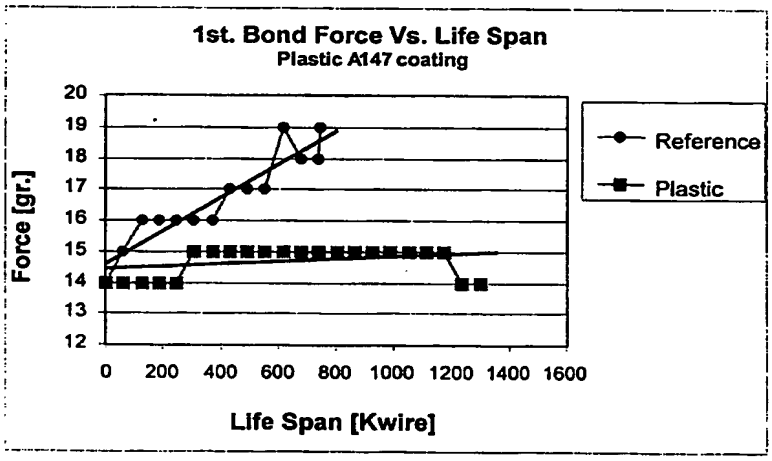

Figure 1: 1st Bond Force versus # of Bonded Wires

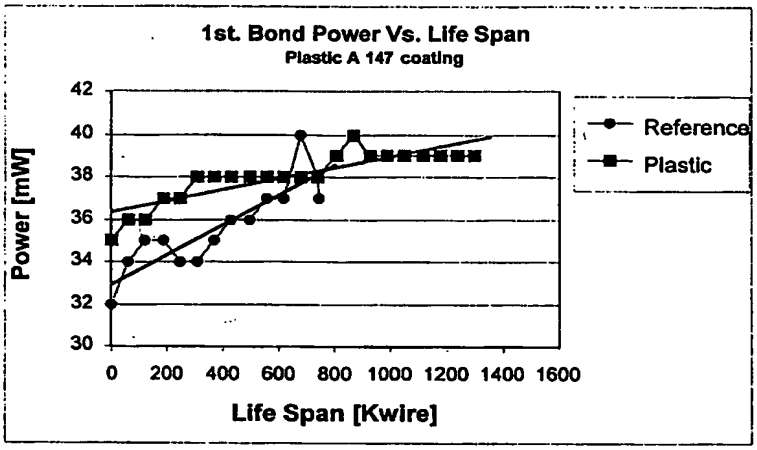

Figure 2: 1st Bond Ultrasonic Power versus Bond Quality as Bond Shear per Unit Area

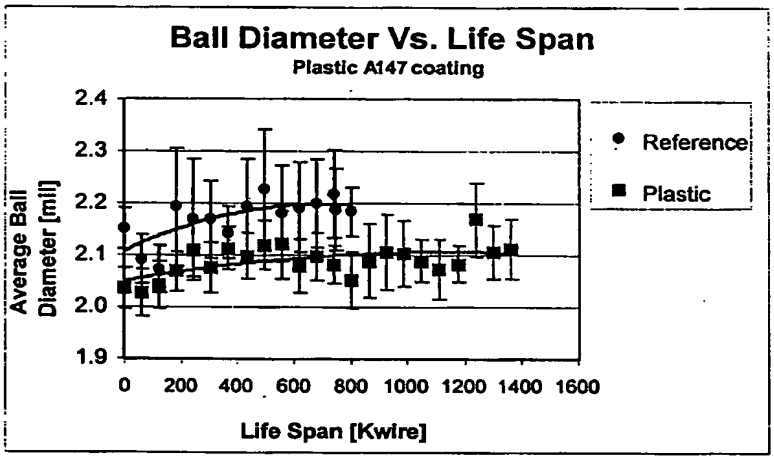

Figure 3: Average Ball Diameter versus Accumulated Number of Wires Bonded

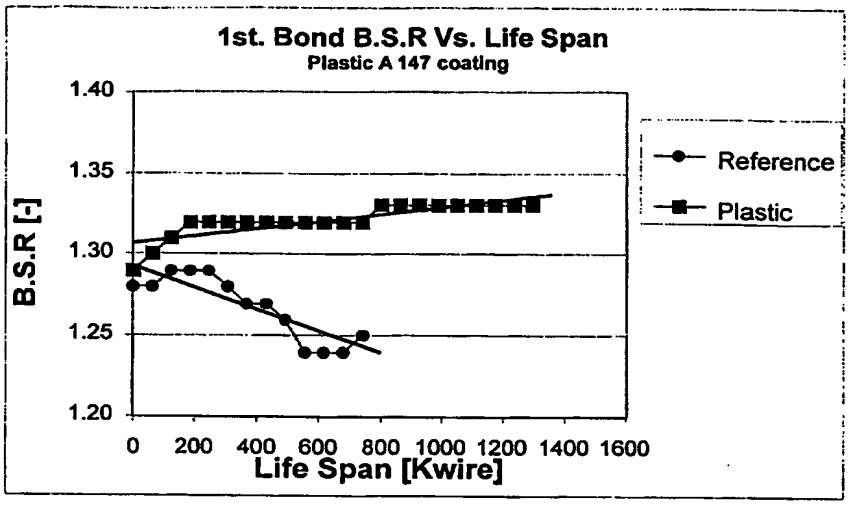

Figure 4: Free Air Ball Size Ratio versus Number of Bonded Wires

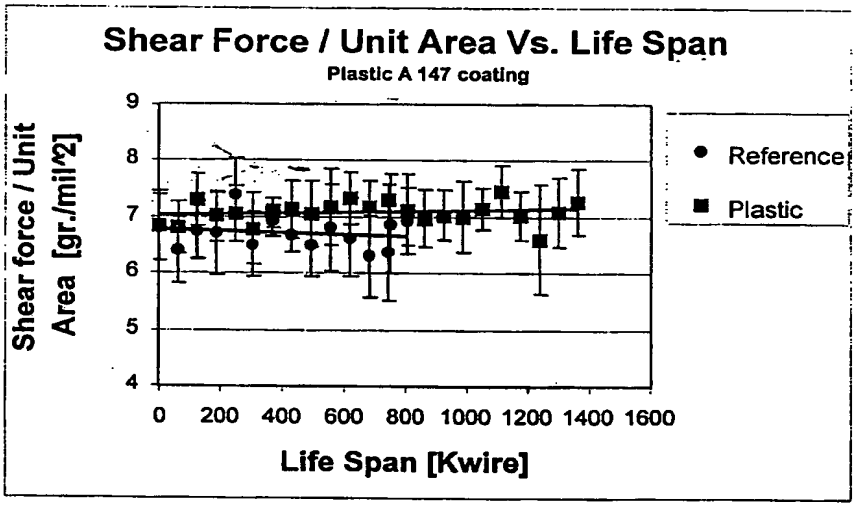

Figure 5: 1st Bond Performance versus Number of Bonded Wires

Coating Process

Capillaries and bonding tools produced by either direct ceramic die pressing followed by sintering or injection molding followed by sintering are machined to final shape by grinding or Electro Discharge Machining operations (EDM). The tools are then placed in a vacuum chamber for coating by vapor phase condensation of a polymer, e.g. Paralyene. Deposition of Poly-Para-Xylylene, for example, is done at 35°C and 0.1 torr of chamber pressure. The precursor monomer is produced from a d-Para-Xylylene dimer vaporized at 150°C and 1.0 torr, followed by high temperature pyrolysis at 690°C and 0.5 torr. This process has been found to be effective in depositing a uniform, continuous coating upon the tool > 1 micron in thickness.

Search Results:

The following documents may have a bearing on the patentability of this technology. This search was done covering the CEABA, COMPENDEX, ENTEC, INSPEC, NTIS and SIGLE Databases through the use of STN Easy Access. General commentary appears that none of these have a direct conflict with this proposed patent.

Title Vacuum arc diamond-like carbon films for tools and lubrication
Publication Source Ind. Horizons (1995) (1), p.8-9, 2f ISSN: 1235-127X **Document Type** Journal **Language** English
Abstract A brief outline of the diamond-like carbon (DLC) films being researched at VTT (Finland). These films can greatly increase the hardness of tools, or decrease friction in surfaces which could not otherwise be lubricated. The vacuum arc discharge deposition apparatus comes equipped with a filtered arc metal plasma source so that film hardness can be increased by interleaving layers of DLC with metal/metal nitride films. Vacuum arc deposition can be used on shapes such as ball bearings and rings, and temperatures can be kept as low as 100 Cel so that even polymer objects can be coated. (MacMillan)
Accession Number 1995:362813

Title Deposition of PVD coatings on different geometries and local characterization for reliable properties.
Author Friedrich, C.; Berg, G. (Inst. of Mater. Sci., Tech. Hochschule Darmstadt, Germany); Senf, J.; Broszeit, E. **Publication Source** Materialwissenschaft und Werkstofftechnik (Feb. 1998) vol.29, no.2, p.72-6. 15 refs.
Published by: VCH Verlagsgesellschaft
CODEN: MATWER ISSN: 0933-5137
SICI: 0933-5137(199802)29:2L.72:DCDG;1-# **Document Type** Journal **Treatment Code** Experimental **Country of Publication** Germany, Federal Republic of **Language** English
Abstract Although the characteristics of PVD coatings in research and development papers are very promising, in the field of tribology the industrial application of these coating types is restricted to special market segments up to now: the deposition of hard coatings is state of the art on tools, whereas PVD coated machine components are quite rare. This is caused by the coatings profile of properties, the various surroundings and the demands for application reliability. The last aspect is the main topic of this contribution. Reliability is especially important for machine components, because tools may fail after relative short life time compared to machine parts. Besides this tools and the corresponding production equipment are designed for fast tool replacement in contrast to other machines, which should work without standstill and with a minimum of maintenance. Characteristics of coated systems must be guaranteed in practice-theory and laboratory experiments have to show what is possible. On the one hand reproduction of the deposition process must be guaranteed to enter application fields with high demands for reliability, on the other hand characterization of coated systems must be standardized with admissible deviations for communication between coaters and users. These aspects are important for decisions concerning the use of coating substrate systems in tribology besides the topics of technical function. The present investigation shows main reasons for deviations in results of PVD coatings.
Accession Number 1998:5936597

Title Wear of tillage tools coated by thermoplastic coatings.
Author Ali, W.Y.; Ezzat, F.M.H. (Fac. of Eng., El-Minia Univ., Egypt) **Publication Source** Wear (April 1994) vol.173, no.1-2, p.115-19. 16 refs. CODEN: WEARCJ ISSN: 0043-1648 **Document Type** Journal **Treatment Code** Experimental **Country of Publication** Switzerland **Language** English
Abstract Experiments were carried out to investigate the abrasive wear of tillage tools caused by soil. Low-carbon steel and hardened steel specimens as well as specimens coated by thermoplastic composites were tested. Silicon oxide (SiO2), aluminium oxide (Al2O3), iron, copper and glass fibre were used as filling materials in polyamide (PA6) and polyethylene (PE) coatings. Low-carbon steel was used as substrate. An abrasive wear tester was constructed to simulate the operation of real tillage tools. The relative motion between the test specimens and soil was controlled. PA6 showed promising results, especially if both the concentration and grain size of the additives were carefully selected. The addition of

iron and Al2O3 powders to PA6 showed a considerable mitigation in the wear process if their concentrations were controlled to a certain limit.
Accession Number 1994:4686867

Title Ultrasonic Wire Bonding.
(Latest citations from Weldasearch). (Published Search.) **Organization** NERAC, Inc., Tolland, CT
Sponsor: National Technical Information Service, Springfield, VA **Country of Publication** United States
Language English
Abstract The bibliography contains citations concerning ultrasonic wire bonding processes, materials, equipment, and applications. Citations focus on tools, control systems, effects of additives, monitoring methods, and evaluations. Topics cover reliability, quality assurance, and statistical process control. Applications include GaAs devices, copperball bonding, single layer polymer hybrid integrated circuits (POLYHICS), thin metallization, and thick film conductors. (Contains 50-250 citations and includes a subject term index and title list.)
Number of Report PB96-871231/XAB 50-250 citations. NTIS Prices: PC N01/MF N01
Notes: Sponsored in part by National Technical Information Service, Springfield, VA. **Publication/Issue Date** Sep 1996 **Accession Number** 1996(24):1621

Long Life Capillary

Capillary Market potential

Introduction

This document describes a rough estimation about the market potential for the long life, highly efficient capillary. This new product is based on a coated capillary with a thin polymer layer. This coating eliminates the built up of contamination on the capillary surface, which was found to be the dominant mechanism of shorten the lifetime of the capillary. Additionally, the bonding process with this capillary is more stable along the entire life of the capillary.

Since the polymer coating is an electrical isolated material, it is also used as isolation for a conductive capillary.

Market Examination

The requirement for long life capillary came from the market. This new product should solve some issues that were raised in the production line:

- Improve the stability and the consistence of the process.
- Increase the throughput of the wire bonding process by saving the setting time of exchanging the wire spool and a capillary simultaneously.
- Reduce the cost of ownership for capillaries in the assembly process.

The potential of launching the Long life capillary is being examined by the product management,in accordance with the specific capillary configuration and type:

1. Standard capillary market. This market is currently estimated to use 100 - 150+ K Capillaries per week. The main advantage in this market is the significant increase of the capillary life which will reduce the number of capillaries required for the overall application, as well as, saving in set up times and machine adjustments.

2. Fine Pitch market. This market is currently estimated to use 100-150 K capillaries saving in set up times.

EXHIBIT 2

Kulicke & Soffa
Industries Inc

2101 Blair Mill Road, Willow Grove, PA 19090
Phone (215) 784-6000 • FAX (215) 659-7588
Writer's Direct: (215) 784-6434 • FAX (215) 784-6483
E-mail: jmoore@kns.com

VIA FEDERAL EXPRESS

February 24, 2000

Jacques L. Etkowicz, Esq.
Ratner & Prestia
Suite 301 One Westlakes (Berwyn)
P.O. Box 980
Valley Forge, PA 19482-0980

RE: KSI-227 A Bonding Tool With Inner and/or Outer Plastic Coating, for Low Drag Force and Longer Life Span

Dear Jack:

Confirming our phone conversation today enclosed is the paperwork to start the patent process for KSI-227.

Sincerely,

Jeffrey C. Moore
General Counsel

Enclosure

PACKING SLIP

DATE: February 24, 2000

FROM: **KULICKE & SOFFA INDUSTRIES, INC.**
2101 Blair Mill Road
Willow Grove, PA 19090

K&S NO: WDX-7339

CUST. P.O. NO.:

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SALESMAN:

ADDRESS:

SHIPPING INSTRUCTIONS:

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Jacques L. Etkowiecz, Esq.
RATNER & PRESTIA
Suite 301
One Westlakes, Berwyn
P.O. Box 980
Valley Forge, PA 19482-0980

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			Documents Value $0 Mary Baum 803111

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ALL CLAIMS MUST BE PRESENTED WITHIN FIVE DAYS AFTER RECEIPT OF MERCHANDISE AND MUST BE ACCOMPANIED BY THIS PACKING LIST
FORM 1013